FIG. 1
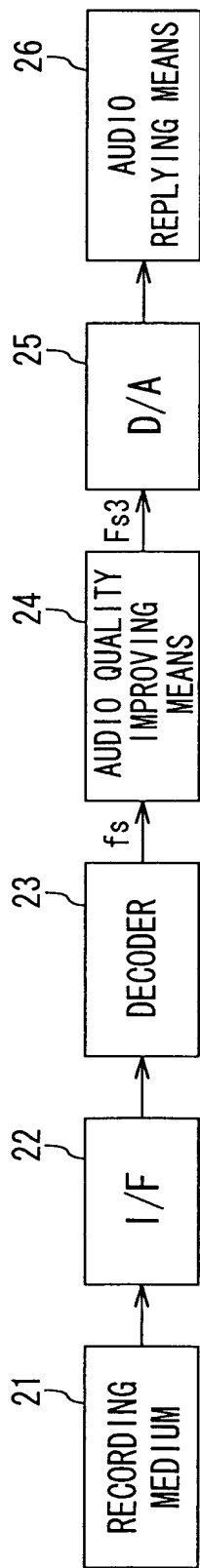
FIG. 2
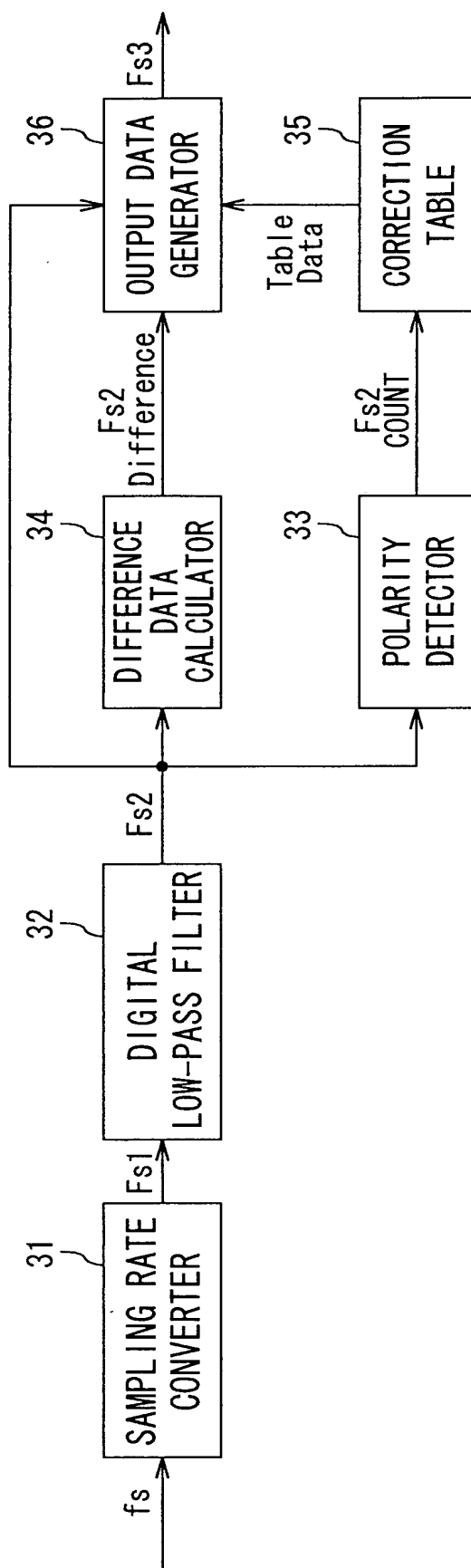
FIG. 3

ALGORITHM OF DOUBLE-EXTENDED SAMPLING

INPUT DATA SAMPLED AT RATE = fs	OUTPUT DATA CONVERTED TO RATE=Fs (=2 × fs)
m	m
m+1	0
m+2	m+1
m+3	0
. . .	m+2
	0
	m+3
	0
	. . .

FIG. 4

CORRECTION TABLE A

Fs2COUNT	3 (=2Fs)	4 (=3Fs)	5 (=4Fs)	6 (=5Fs)
n=1	0	0	0	0
n=2	$1/4(=\alpha)$	$1/4(=\alpha)$	$1/4(=\alpha)$	$1/4(=\alpha)$
n=3	–	$-1/4(=\beta)$	0	0
n=4	–	–	$-1/4(=\beta)$	0
n=5	–	–	–	$-1/4(=\beta)$

FIG. 5A

CORRECTION TABLE B

Fs2COUNT	3 (=2Fs)	4 (=3Fs)	5 (=4Fs)	6 (=5Fs)
n=1	0	0	0	0
n=2	$-1/4(=\beta)$	$-1/4(=\gamma)$	$-1/4(=\gamma)$	$-1/4(=\gamma)$
n=3	–	$1/4(=\theta)$	0	0
n=4	–	–	$1/4(=\theta)$	0
n=5	–	–	–	$1/4(=\theta)$

FIG. 5B

START

SAMPLING RATE CONVERSION ── 31

SCALING ── 31A

LOW-PASS FILTERING ── 32

CALCULATION OF DIFFERENCE DATA ┄┄ 34

101 — $PCM(Z^{-1}) < PCM(Z^0)$? — YES

NO

103
$PCMREF(Z^0) = PCM(Z^{-1}) - PCM(Z^0)$
$POLA(Z^0) = FALSE$

102
$PCMREF(Z^0) = PCM(Z^0) - PCM(Z^{-1})$
$POLA(Z^0) = TRUE$

POLARITY DETECTION ┄┄ 33

104 — $POLA(Z^{-1}) = POLA(Z^0)$? — YES

NO

107
$PCM(Z^{-1}) = PCM(Z^0)$
$POLA(Z^{-1}) = POLA(Z^0)$

105
$PCM(Z^{-1}) = PCM(Z^0)$
$POLA(Z^{-1}) = POLA(Z^0)$

108 — $2 < FSCOUNT \leqq FSTBLMAX$? — NO

106
$FSCOUNT = FSCOUNT + 1$
$FSUPSW = TRUE$

YES

109
$FSCOUNT = FSCOUNT + 1$
$FSUPSW = TRUE$

110
(ABNORMAL PROCESSING)
$FSCOUNT = 0$
$FSUPSW = FALSE$
$PCM = PCM(Z^0)$
$PCMREF(Z^{-1}) = 0$
$POLA(Z^{-1}) = FALSE$
$POLA(Z^0) = TRUE$

$FSUPSW = TRUE$? — YES

NO

Ⓐ

Ⓑ

FIG. 6

Ⓑ

36

GENERATION OF OUTPUT DATA

$BP = FSCOUNT - 1$ ——112

$n = BP$ ——113

114
$POLA(Z^0) = TRUE$? —— YES

NO

115
$PCM(Z^{-n}) = PCM(Z^{-n}) + PCMREF(Z^{-n}) \times$ CORRECTION COEFFICIENT $A(Z^{-n})$

117
$n = n - 1$

116
$0 < n \leqq BP$? —— YES

NO

118
$PCM(Z^{-n}) = PCM(Z^{-n}) + PCMREF(Z^{-n}) \times$ CORRECTION COEFFICIENT $B(Z^{-n})$

120
$n = n - 1$

119
$0 < n \leqq BP$? —— YES

NO

Ⓐ

RE-SCALING ——121

OUTPUT TO D/A CONVERTER ——122

E N D

FIG. 7

WHEN CORRECTION VALUES ARE a to d AND VALUES FROM CORRECTION TABLES ARE α to θ:

OUTPUT PCM DATA:

BP=2Fs
$a=(ABS(A-B))* \alpha$
$b=(ABS(C-D))* \beta$
$\alpha=1/4, \beta=-1/4$

A=A
B=B+a (ADDI.)
C=C
D=D+b (SUB.)

BP=3Fs
$a=(ABS(A-B))* \alpha$
$b=(ABS(C-D))* \beta$
$c=(ABS(D-E))* \gamma$
$d=(ABS(F-G))* \theta$
$\alpha=1/4, \beta=-1/4,$
$\gamma=-1/4, \theta=1/4$

A=A
B=B+a (ADDI.)
C=C+b (SUB.)
D=D
E=E+c (SUB.)
F=F+d (ADDI.)

BP=4Fs
$a=(ABS(A-B))* \alpha$
$b=(ABS(D-E))* \beta$
$c=(ABS(E-F))* \gamma$
$d=(ABS(H-I))* \theta$
$\alpha=1/2, \beta=-1/2,$
$\gamma=-1/2, \theta=1/2$

A=A
B=B+a (ADDI.)
C=C
D=D+b (SUB.)
E=E
F=F+c (SUB.)
G=G
H=H+d (ADDI.)
I=I

BP=5Fs
$a=(ABS(A-B))* \alpha$
$b=(ABS(E-F))* \beta$
$c=(ABS(F-G))* \gamma$
$d=(ABS(J-K))* \theta$
$\alpha=1/2, \beta=-1/2,$
$\gamma=-1/2, \theta=1/2$

A=A
B=B+a (ADDI.)
C=C
D=D
E=E+b (SUB.)
F=F
G=G+c (SUB.)
H=H
I=I
J=J+d (ADDI.)
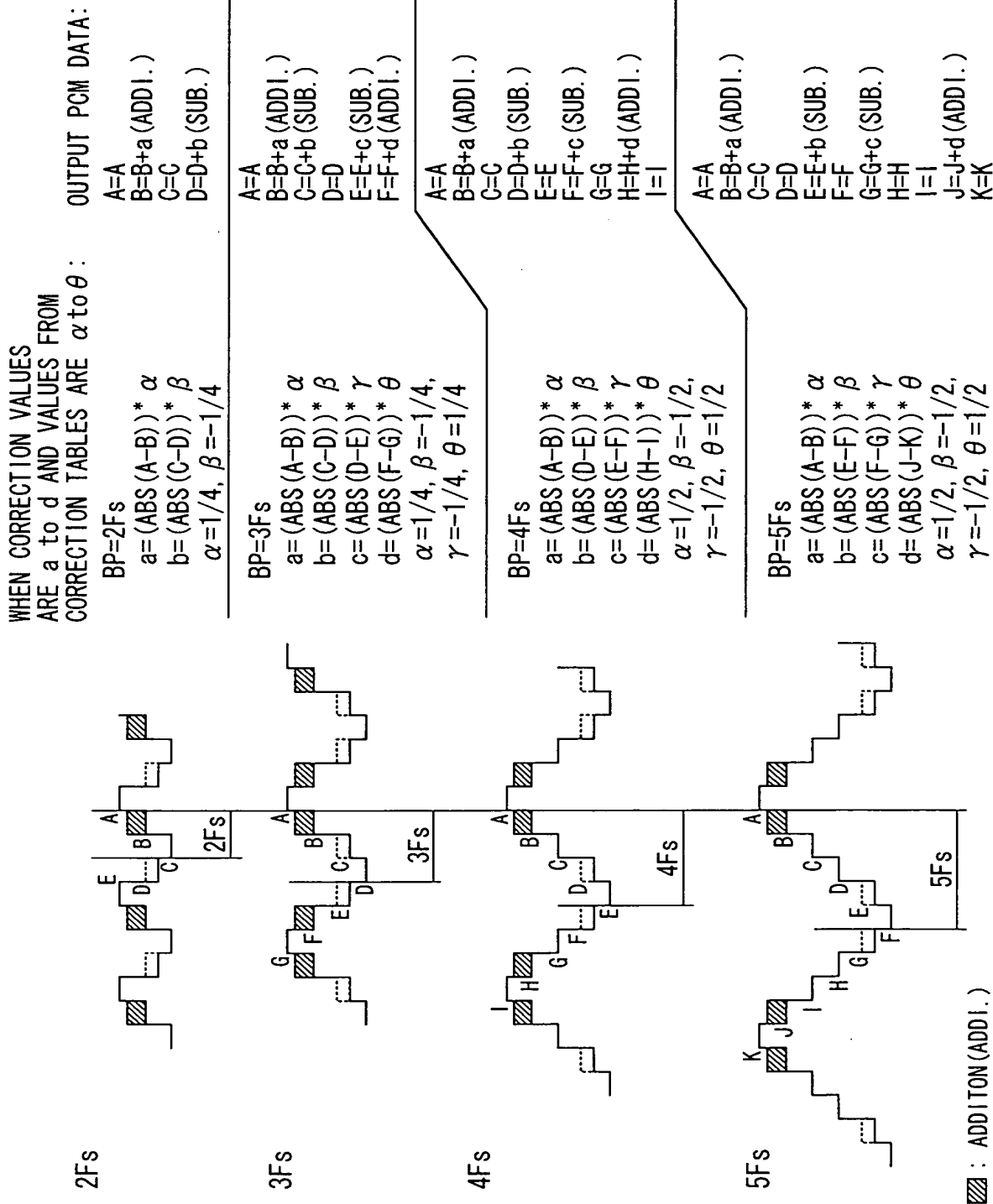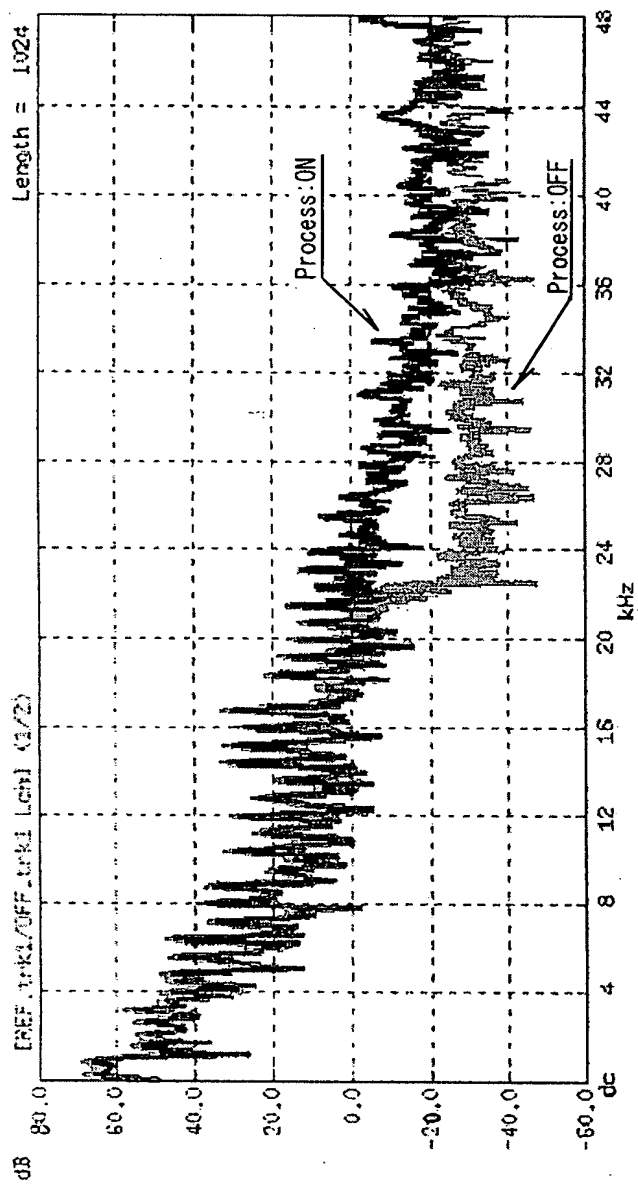K=K

2Fs

3Fs

4Fs

5Fs

: ADDITON(ADDI.)
: SUBTRACTION(SUB.)

FIG. 8

OUTPUT LEVELS OF SPECTRUM ANALYZER

[UPPER(ON) :WITH VOICE-QUALITY IMPROVEMENT PROCESSING]
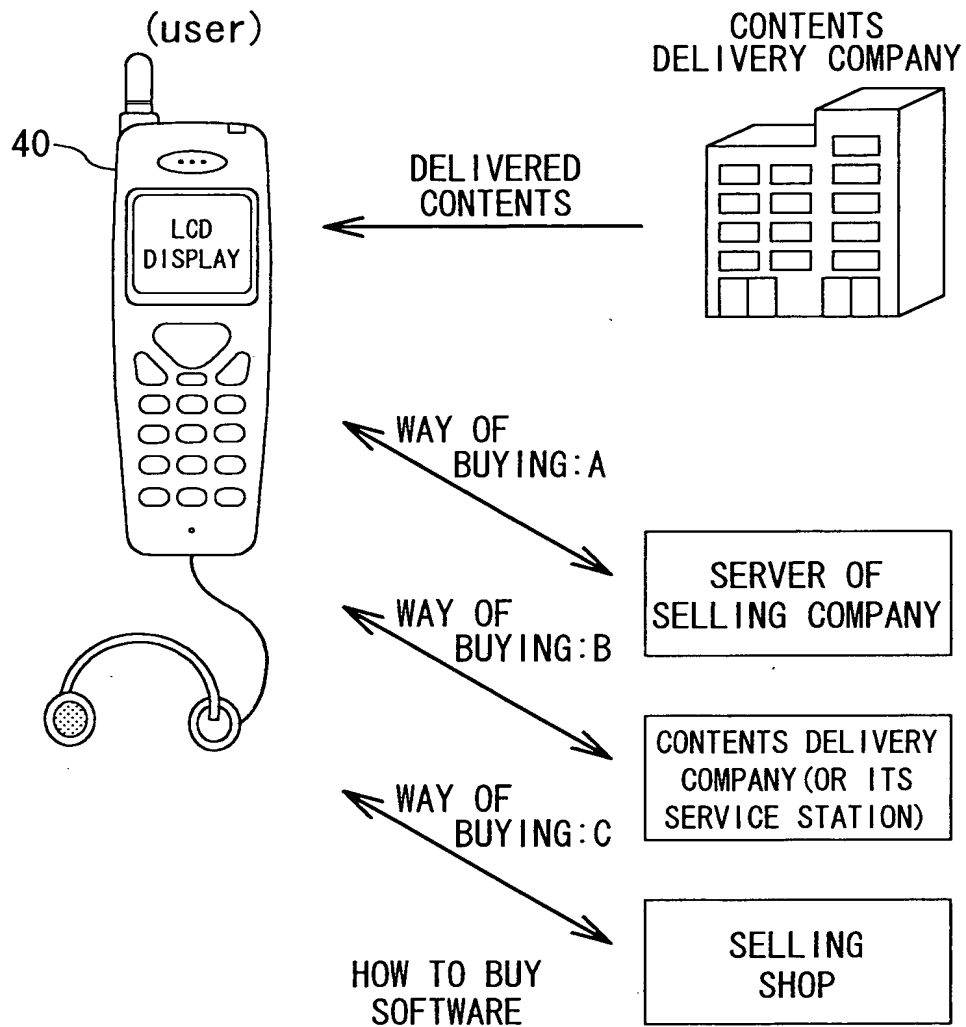[LOWER(OFF):WITHOUT VOICE-QUALITY IMPROVEMENT PROCESSING]

FIG. 9

FIG. 10

FIG. 11